Project Name:	Beton - mixing and pouring concrete floors	**Start Date:**	2022-04-17
Project Number:	2222	**Completion Date:**	2022-11-23

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Compressive strength (mPa)	30	50	Yes

The following example is based on the Tax Court of Canada judgement BETON WORKSHOP INC., and HER MAJESTY THE QUEEN, Jan 27, 2022.

m) the objective of the project claimed by the appellant was to improve the process for mixing and pouring polished concrete floors in order to reduce the visibility of aggregates while:

respecting the compressive strength of 30-50 MPa;

eliminating the formation of cracks;

controlling the appearance of surface aggregates, surface color and uniformity, etc.;

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Frederic Tremblay (Beton Workshop) (History & Geography - BA (1990) / President of Beton)
Evidence types:	Samples, prototypes, scrap or other artefacts; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: As Claimed = LOSS

n) the appellant encountered uncertainties of a technical nature in relation to the choice of:

proportions of ingredients for concrete formulation to obtain a polished surface, without cracking and of good color;

chemical additives;

the casting method to obtain the desired appearance and mechanical properties;

The most significant underlying key variables are:

additives (unresolved), casting methods (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: Claimant arguments (Fiscal Year 2022)

Methods of experimentation:

Method	Experimentation Performed
Trials:	10 runs / samples

o) in an attempt to resolve the aforementioned technical uncertainties, the appellant used a trial and error approach,

involving, among other things:

the development of:

different concrete formulations by changing the percentage of ingredients;

a concrete recipe with few surface aggregates;

the modification by adding:

the additive which is the super plasticizer;

fly ash;

shrinkage reducer;

testing of different formulations and different casting processes in the laboratory;

concrete design and pour testing on a commercial site;

Results:

- Compressive strength: 50 mPa (100% of goal)

Conclusion:

Documentation:

- Offline Documents: docs

Uncertainty #2: Ideas per Expert witness

[26] Regarding the project for the mixing and pouring of polished concrete floors, Mr. Migneault made the following comments:

DEFINING KNOWN OR STANDARD INDUSTRY PRACTICES

concrete floors, even polished, do not represent a new product on the market. This area is also regulated. Public knowledge and the standards in force provided enough information to carry out the development of a manufacturing process or the improvement of this type of product;

from the starting formulation established by what is known in the field, the appellant then made educated guesses in order to achieve the desired characteristics for the product, polished concrete floors;

in order to increase the fluidity of the concrete, the appellant decided to add a super plasticizer. Super plasticizers have the property of making the concrete more fluid (plasticizing effect) and of increasing the strength of the concrete (compressive strength) thanks to the reduction of water that their use allows. The use of the product designed for this purpose gives the expected result and does not constitute an advancement;

in test # 7 , the fly ash was removed from the formulation and replaced with a shrinkage reducing agent, a product known to also reduce the formulation of cracks;

the cement mainly used (FA-56) seems to contain an air entrainer (foaming agent). The shrinkage-reducing agent will reduce this effect, but is not sufficient on its own, hence the use of a cure sheet. Therefore, the problems of cracks on the surface of the concrete and pores observed have been resolved with solutions known in the field and do not represent an advancement;

the type of super plasticizer used, naphthalene type, is a second generation plasticizer for concrete with an intermediate water reduction capacity.

Third-generation water reducers already existed back then. They provide superior water reduction while increasing the compressive strength of concrete. This type of concrete is called UHP (Ultra High Performance) concrete and is used today by the appellant.

The appellant increased knowledge base of products available on the market and of handling concrete.

The most significant underlying key variables are:

fibre types (unresolved), cement types (unresolved), water types and amounts (unresolved), setting times (unresolved), super plasiticers & foaming agents (unresolved)

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Suppliers	2 products	The expert witness clarified that third generation plasticizers already on market to solve problems cited

Activity #2-1: Expert witness critique (Fiscal Year 2022)

Methods of experimentation:

[26] Regarding the project for the mixing and pouring of polished concrete floors, Mr. Migneault made the following comments:

FACTORS INDICATING LACK OF SYSTEMATIC INVESTIGATION:

from the starting formulation established by what is known in the field, the appellant then made educated guesses in order to achieve the desired characteristics for the product, polished concrete floors;

the problems encountered were of a technical nature. Some have been resolved by solutions known in the field: the use of a shrinkage reducing agent and curing sheets for the reduction of surface cracks. Other solutions, such as adding fly ash causing unwanted staining, were simply circumvented or abandoned;

for this project, the type of client used is not indicated anywhere. Looking at the invoices, most of the cement purchased for the projects is a specialized type of cement for exterior structural repairs;

the type of water used during the tests is not indicated;

the bleeding observed during the first test can have several causes: too much water, poor handling after pouring, too long a setting time for cold weather. Only one cause has been explored: water reduction;

in tests no . 5 and no . 6, fly ash is added to reduce cracking. Invisible color develops as it dries. The appellant did not attempt to determine the cause of the problem and decided to simply remove the ingredient from the product formulation;

for the reproducibility tests carried out, experiment sheets are not provided and no results are reported;

the appellant acknowledges, for lack of resources, that all the possible causes of the failures were not examined;

Results:

As a result the expert proposed:

This is an apprenticeship that does not constitute an advancement;

the work was intended to support the appellant's learning in the manufacture of an existing product on the market, namely polished concrete floors;

although a register exists (experiment sheets), it does not contain hypotheses, nor all the measurements allowing to establish a relation of cause and effect in the parameters explored;

several important measurements, such as setting time, time between casting, measurement of surface hardness and concrete strength (compressive strength are not reported or are missing).

Conclusion:

Judge concluded:

[40] The appellant succeeded in developing modular concrete panels and polished concrete floors meeting the desired characteristics, but the appellant succeeded in doing so by using known technologies to solve the technical problems encountered. The comprehensive approach adopted was not aimed at achieving scientific or technological advancement.